Mindfulness Meditation and Evidence of Brain Changes: A Review of the Literature

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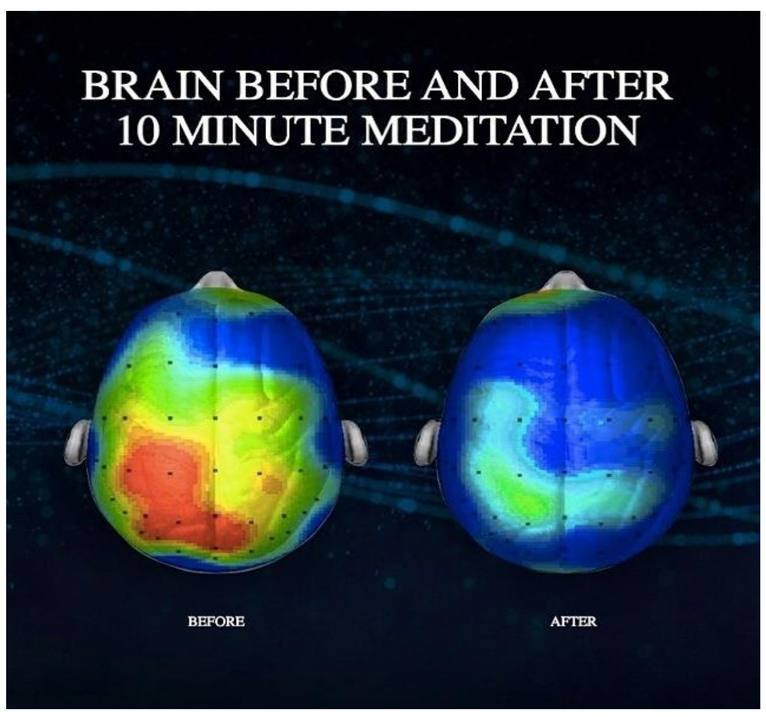
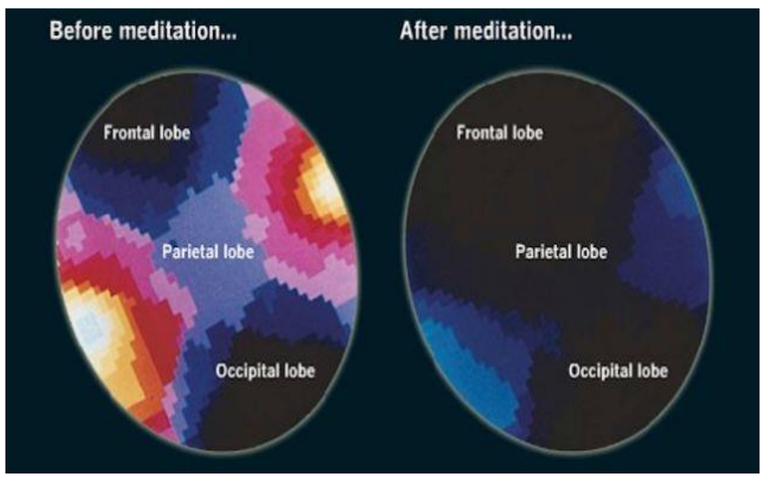
Abstract

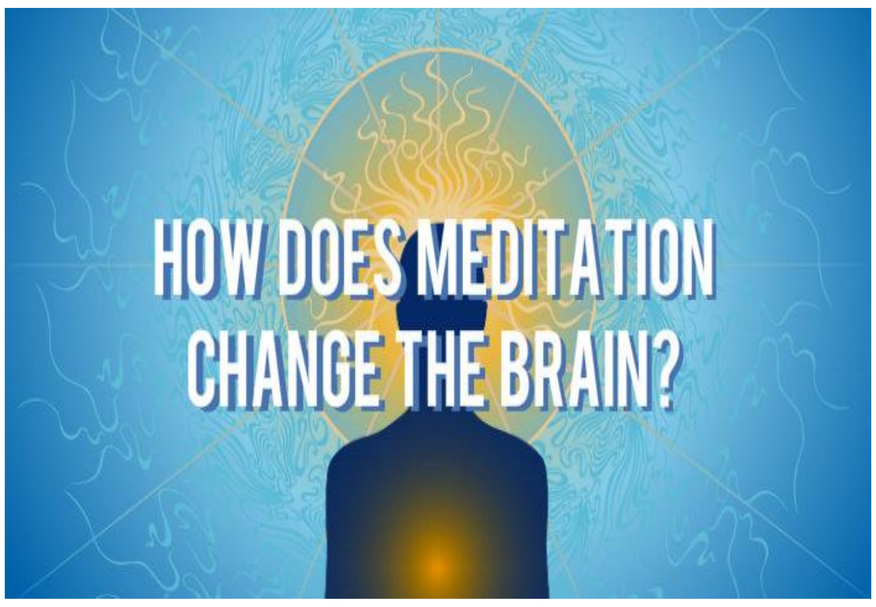
Mindfulness meditation is a practice that can develop greater awareness of the mind and body. It has been used to treat stress, anxiety, chronic pain (12) and depression. Current studies shed light on research findings associated with the effects of mindfulness meditation on the brain. This literature review will reveal evidence of neuroplasticity through functional imaging, such as the fMRI. Likewise, evidence of emotional regulation involving amygdala activation has been in presented in some studies (4,2). Additionally, increased gray matter density in the brain stem has been documented after meditation therapy (MT) using magnetic resonance imaging(9). Researchers have additionally uncovered significant improvements in immune system function among meditators (10).





Key Questions

- To examine the association between mindfulness meditation and the neuroplasticity of the brain.
- To determine the relationship between MT and reduction in stress, depression and anxiety.



Main Arguments

There are a variety of benefits resulting from mindfulness meditation that include stress and anxiety reduction, emotional regulation and management of chronic pain. In recent years, science has been catching up and confirming many of these effects empirically as researchers across disciplines investigate the neurological and physiological effects of mindful meditation (9). Meditation had been used to help ~~treat~~ cancer patients manage stress (13). There is evidence of neuroplastic effects in the brain after meditation training (MT) resulting in improved self-regulation, cognition and neural processing (1,12). Most research makes use of fMRI imaging that compares the brains of study participants before and after mindfulness meditation (14). The effects of such programs have demonstrated numerous neural changes (6). For instance amygdala activity after MT suggests potential for lasting changes in brain function, specifically emotional responses (2,3,5). Right side amygdala activity decreased after a mindfulness based stress reduction program, suggesting reduced reaction to negative emotional stimulus in social anxiety disorder (SAD) patients (2). Amygdala connectivity changes were similarly correlated with the Beck Anxiety Inventory (4) in general anxiety disorder (GAD) patients following MBSR, along with reduced anxiety and stress symptoms (7) .

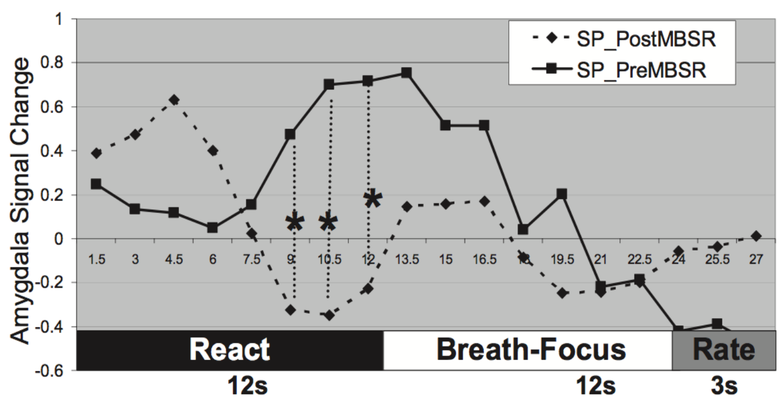
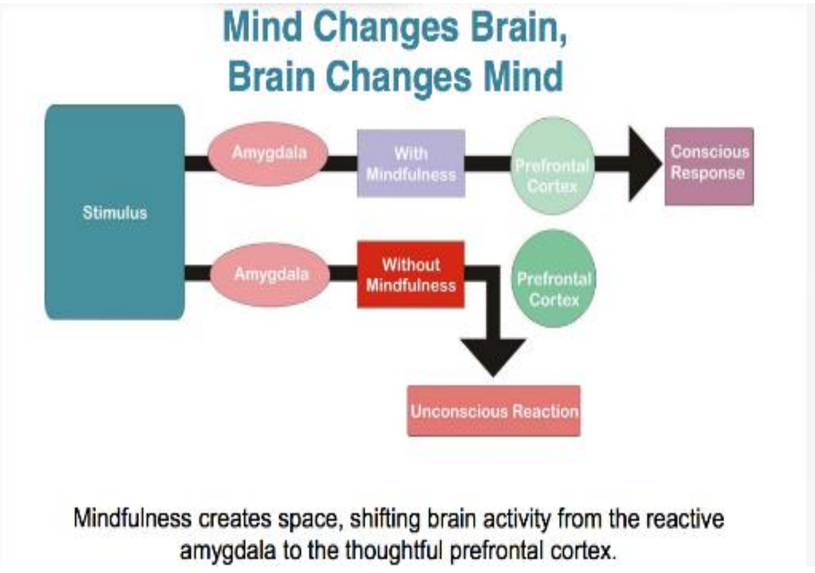


Figure 5. Right dorsal amygdala blood oxygenation level-dependent (BOLD) contrast signal time series during reacting to negative self-beliefs and breath-focused attention in social phobics (SP) at both pre- and post-mindfulness-based stress reduction (MBSR). * $p < .05$. Rate = negative emotion rating; React = reacting to the negative self-belief; Breath-Focus = instruction to focus attention on breath sensation.

Other research indicates improved immune system function among MBSR participants who show elevated levels of antibody titers compared with non-meditators (10). Long-term meditators have shown an increase in gray mater density(9,11).

Conclusion

Mindfulness meditation has been shown to change the way people think, the way we respond to stimuli and even the physical structure of our brains. A more comprehensive understanding of the physical and neural changes that MT causes, and the capacity for the brain to change, could be used to improve upon current MT therapies and their application. Similarly, MT related changes in neuro-activity could lead to new psychological treatments in coming years. For instance better understanding of the plasticity of the amygdala could be helpful in developing new treatments for mood disorders, fears, addiction and anxiety. MT's mind, body, and internal awareness benefits could likewise be applied to treatment of borderline personality disorder. Channeling of attention, and control of focus could aid people with ADD. MBSR therapeutic programs have been adopted for use in mainstream medicine and used as templates for other psychotherapies, and should continue to be built upon. Additionally, study of other stress reduction techniques, such as meditative prayer (15) along with mindfulness meditation should be studied in parallel to potentially expand treatment options based on the most effective technique for a given patient.



Mindfulness creates space, shifting brain activity from the reactive amygdala to the thoughtful prefrontal cortex.

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